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Botanical Resources and Wetlands Technical Report

Shasta Lake Water Resources Investigation, California

Prepared by:

United States Department of the Interior
Bureau of Reclamation
Mid-Pacific Region

U.S. Department of the Interior
Bureau of Reclamation

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Abbreviations and Acronyms

Arid West	Interim Regional Supplement to the Corps of Engineers Manual Wetland Delineation Manual: Arid West Region
Bay-Delta	San Francisco Bay/Sacramento–San Joaquin River Delta
BLM	U.S. Bureau of Land Management
BMP	best management practices
CALFED	CALFED Bay-Delta Program
CalIPC	California Invasive Plant Council
CCR	California Code of Regulations
CCWD	Contra Costa Water District
CDFA	California Department of Food and Agriculture
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
Corps Manual	Corps of Engineers Wetlands Delineation Manual
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWA	Clean Water Act
DBH	diameter at breast height
Delta	Sacramento–San Joaquin River Delta
DFG	California Department of Fish and Game
DWR	California Department of Water Resources
EBMUD	East Bay Municipal Utility District
EIR	environmental impact report
EIS	environmental impact statement
ESA	Federal Endangered Species Act
FAC	facultative plants
FACW	facultative wetland plants
FEIS/EIR	final environmental impact statement/environmental impact report
FRWP	Freeport Regional Water Project
GIS	geographic information system

LRMP	land and resource management plan
MCV	Manual of California Vegetation
Mendocino NF LRMP	Mendocino National Forest Land Resource Management Plan
MSCS	Multi-Species Conservation Strategy
msl	mean sea level
NCCP	Natural Community Conservation Plan
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NI	no indicator
NL	not listed
NMFS	National Marine Fisheries Service
NOI	notice of intent
NOP	notice of preparation
NPPA	California Native Plant Protection Act
NRA	National Recreation Area
NSR	North State Resources
OBL	obligate wetland plants
OCAP	Operations Criteria and Plan
OHWM	ordinary high-water mark
PCWA	Placer County Water Agency
PFR	Plan Formulation Report
Porter-Cologne Act	Porter-Cologne Water Quality Control Act
RBDD	Red Bluff Diversion Dam
RCD	resource conservation district
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
RHJV	Riparian Habitat Joint Venture
ROD	record of decision
RWQCB	regional water quality control board
SAFCA	Sacramento Area Flood Control Agency
SB	Senate Bill
SCWA	Sacramento County Water Agency
SLWRI	Shasta Lake Water Resources Investigation
SRCA	Sacramento River Conservation Area
SRNWR	Sacramento National Wildlife Reserve
STNF	Shasta-Trinity National Forest
SWAG	Sacramento Watersheds Action Group
SWP	State Water Project

SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TAF	thousand acre-feet
TES	Threatened and Endangered Species
TNC	The Nature Conservancy
UPL	obligate upland plants
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WDR	Waste Discharge Requirement
WHR	Wildlife Habitats Relationship System

Chapter 1
Affected Environment

This chapter describes the affected environment related to botanical resources for the dam and reservoir modifications proposed under the Shasta Lake Water Resources Investigation (SLWRI).

The botanical resources and wetlands setting for the Shasta Lake and vicinity portion of the primary study area consists of the impoundment area (five arms and the Main Body of Shasta Lake, as described below) and the relocation areas (Figure 1-1).

Reclamation established project boundaries for focused surveys in the areas that would be subject to inundation under the various enlargement scenarios. The lower boundary corresponds to the current full-pool elevation defined by Reclamation (1,070-foot mean sea level (msl) contour line). The upper boundary was established using the 1,090-foot msl contour line around the entire lake. This area is referred to as the "impoundment area" (Figure 1-1).

Areas subject to physical disturbance as an indirect result of the proposed project (i.e., areas proposed as relocation sites for roadways, bridges, utilities, and campgrounds that would be inundated after the enlargement of Shasta Dam as well as proposed dike locations) were incorporated into the Shasta Lake and vicinity portion of the primary study area. These locations are hereafter referred to as "relocation areas" (Figure 1-1).

To examine the biological resources along riverine reaches that would be subject to inundation if Shasta Dam were enlarged, reaches of 11 streams and rivers that are tributary to Shasta Lake were also incorporated into the Shasta Lake and vicinity portion of the primary study area. These streams were selected by Reclamation in conjunction with USFS as an initial sampling of streams representative of riverine and riparian habitats. Subsequently, botany studies have been expanded into select areas of the impoundment area and within all of the relocation areas.

For the purposes of this investigation, approximate acreages for vegetation types and waters of the United States are reported by arm of the lake. For a relocation area that falls between two arms, the area is included with the arm that has the most acreage of the vegetation type or water of the United States.

Vegetation communities and special-status plant species in the extended study area are discussed in less detail. The extended study area includes the Sacramento River basin from Red Bluff Diversion Dam (RBDD) south to the Delta. It also includes the San Francisco Bay/Sacramento–San Joaquin River

Delta (Bay-Delta) area and portions of the American River basin, San Joaquin River basin, and the water service areas of the CVP and the SWP.

Descriptions of biological resources were derived primarily from the following sources:

- Shasta Lake Water Resources Investigation Mission Statement Milestone Report (Reclamation 2003)
- Shasta Lake Water Resources Investigation Initial Alternatives Information Report (Reclamation 2004)
- Chapter 3, "Biological Environment," in the Draft Shasta Lake Water Resources Investigation Plan Formulation Report (Reclamation 2007)
- U.S. Fish and Wildlife Service (USFWS) Endangered Species Lists
- The California Natural Diversity Database (CNDDB)
- The California Native Plant Society (CNPS) online inventory

Several attachments provide detailed lists and descriptions of special-status species present in the primary and extended study areas:

- Attachment 1, "Lists of All Special-Status Plant Species Known from or Potentially Present in the Primary and Extended Study Areas"
- Attachment 2, "List of Plant Species Observed in the Shasta Lake and Vicinity Portion of the Primary Study Area"
- Attachment 3, "Special-Status Plant Species Known to Occur in the Shasta Lake and Vicinity Portion of the Primary Study Area"
- Attachment 4, "List of All Sensitive Plant Species in the Extended Study Area Reported to the CNDDB"
- Attachment 5, "Known Weed Source Locations, Potential Mode of Spread, and Risk of Spread"

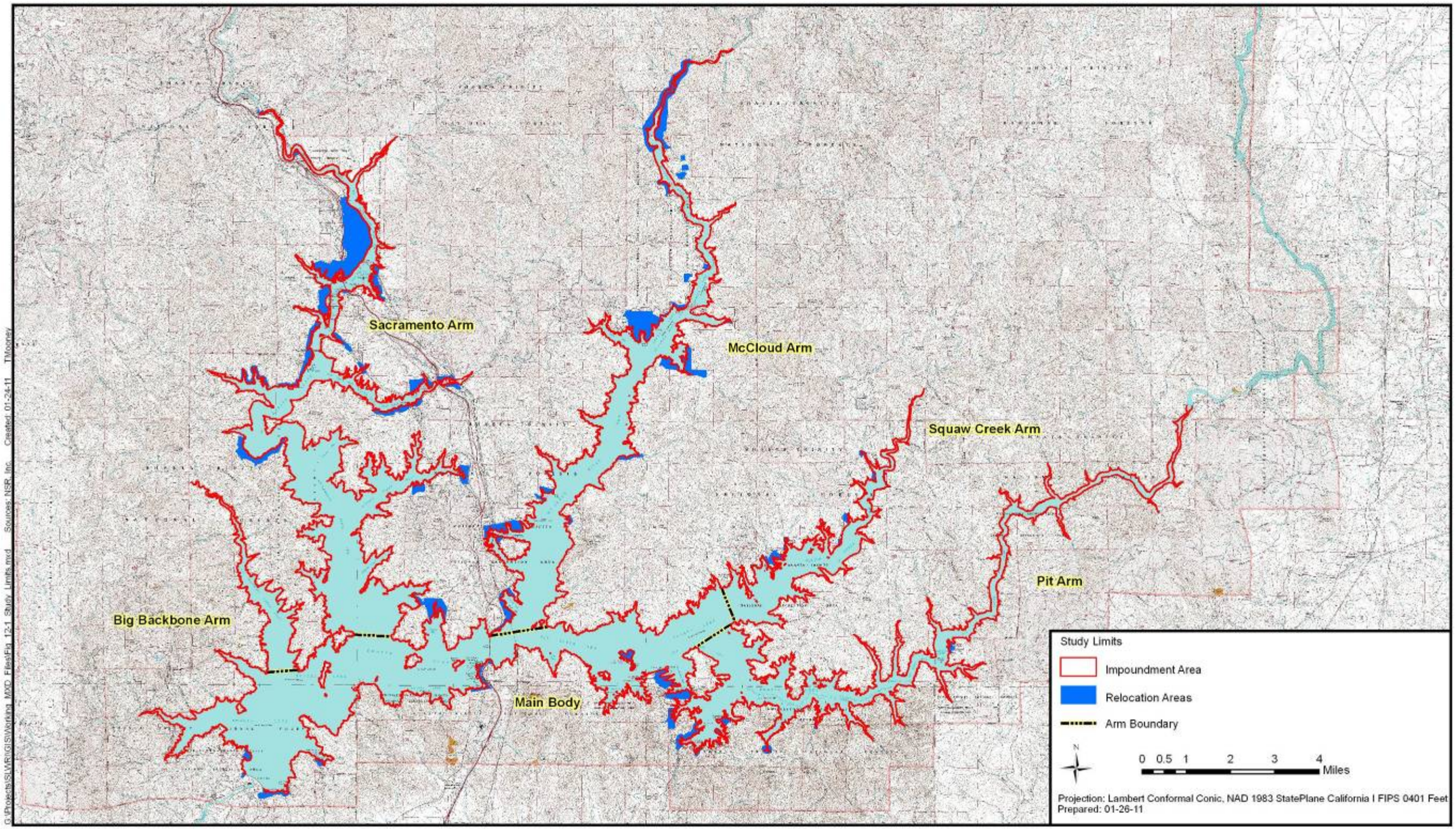

Figure 1-1. Study Limits

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Environmental Setting

Overview for Shasta Lake and Vicinity

Shasta Dam and Shasta Lake are located on the upper Sacramento River in Northern California. Shasta Dam is located about 9 miles northwest of Redding, and the dam and entire reservoir are located within Shasta County. Elevations in the Shasta Lake vicinity portion of the primary study area range between approximately 1,070 and 1,200 feet, and the terrain is moderate to steep.

Biological resources in the Shasta Lake and vicinity portion of the primary study area result from a wealth and diversity of climatic and vegetative associations within and adjacent to the study area. Influences from the Coast Ranges, southern Cascades, northern Sierra Nevada, the Great Basin, and the Central Valley provide for a unique mix of biota.

Vegetation Communities

Primary Study Area

Shasta Lake and Vicinity NSR conducted extensive mapping to characterize the plant communities in the Shasta Lake and vicinity portion of the primary study area. The study area for botanical resources in the Shasta Lake and vicinity portion of the primary study area corresponds to the area that would be subject to inundation under the five action alternatives and areas where infrastructure would be removed, modified, or relocated (Figure 1-1). The vegetation mapping followed the technical approach described in *A Manual of California Vegetation* (Sawyer and Keeler-Wolf 1995) (MCV), using the vegetation alliance classification system described in *A Manual of California Vegetation, Second Edition* (Sawyer et al. 2009).

MCV represents the most recent effort to provide a common and accepted vegetation classification system for use throughout California. It classifies vegetation into a set of plant alliances, provisional alliances, special stands, or semi-natural stands. In this system, the plant species dominance or importance in the layer (i.e., tree, shrub, and ground) with the greatest amount of cover determines the vegetation alliance classification. The same approach used to describe and classify MCV types was applied when other vegetation types not described in the current MCV were encountered and determined to be significant vegetative components.

The vegetation mapping used recent 1:2,400-scale color aerial photography provided by Reclamation. All vegetation mapping was performed in the field by ground truthing the study area from boat, vehicle, and/or on foot. MCV plant alliances were identified and delineated onto the aerial photographs. The delineated boundaries were digitized and generated in ArcGIS/ArcInfo software for display and data query purposes.

The Shasta Lake and vicinity area is characterized by a variety of vegetation types typical of transitional mixed woodland and low-elevation forest habitats. MCV plant series types in this portion of the primary study area are birch-leaf mountain mahogany chaparral, black willow thicket, blue oak woodland, Brewer's oak scrub, buck brush chaparral, California annual grassland, California black oak forest, California ash chaparral, California buckeye groves, California yerba santa scrub, canyon live oak forest, deer brush chaparral, Fremont cottonwood forest, ghost pine woodland, Himalayan blackberry brambles, interior live oak chaparral, interior live oak woodland, knobcone pine forest, mixed willow, Oregon ash groves, Oregon white oak woodland, pale spike rush marshes, ponderosa pine–Douglas fir forest, ponderosa pine forest, red osier thickets, sandbar willow thickets, spicebush thickets, valley oak woodland, white alder groves, and white leaf manzanita chaparral. Vegetation in each of these series varies, with dramatic changes often occurring in relation to aspect, slope, geologic substrate, or juxtaposition with other habitats.

The acreage of MCV types found in the impoundment area along the Main Body and the five arms of Shasta Lake is shown in Table 1-1, and the acreage of MCV types found in the relocation areas along the Main Body and the five arms of Shasta Lake is shown in Table 1-2. The locations of each type are depicted in Figures 1-2a through 1-2f. General descriptions of each type are provided below.

Table 1-1. Summary of Plant Communities in the Impoundment Area

Plant Series	Area (Acres)					
	Main Body	Big Backbone Arm	Sacramento Arm	McCloud Arm	Squaw Creek Arm	Pit Arm
Barren[1]	1.05	0.00	0.55	0.00	0.00	0.00
Birch-leaf mountain-mahogany chaparral	0.00	0.00	0.00	2.23	0.00	0.00
Black willow thicket	0.00	0.00	0.02	0.00	0.00	0.02
Blue oak woodland	1.27	0.00	0.00	0.70	0.00	4.07
Brewer oak scrub	9.78	0.17	51.64	4.99	4.50	7.78
Buck brush chaparral	1.46	2.42	2.11	1.59	0.67	0.19
California annual grassland	0.58	0.33	4.17	0.94	0.00	0.33
California black oak forest	71.45	14.14	160.32	47.44	1.72	5.05
California buckeye groves	0.00	0.00	0.20	0.001	0.00	0.00
California yerba santa scrub	0.00	0.00	0.00	0.00	0.00	15.89

Table 1-1. Summary of Plant Communities in the Impoundment Area (contd.)

Plant Series	Area (Acres)					
	Main Body	Big Backbone Arm	Sacramento Arm	McCloud Arm	Squaw Creek Arm	Pit Arm
Canyon live oak forest	9.80	18.41	53.80	48.40	26.79	110.51
Deer brush chaparral	0.18	0.00	0.00	0.08	0.00	2.34
Fremont cottonwood forest	0.00	0.00	0.07	0.00	0.00	0.05
Ghost pine woodland	54.05	0.00	51.29	13.50	22.03	30.54
Himalayan blackberry brambles	0.00	0.00	0.00	0.00	0.00	0.44
Interior live oak chaparral	1.24	0.00	10.05	0.01	0.00	24.86
Interior live oak woodland	2.00	0.00	0.14	0.09	0.00	2.28
Lacustrine**	10,196.88	1,014.12	7,225.14	5,032.68	2,081.60	4,372.80
Knobcone pine forest	32.96	0.40	16.38	20.61	47.92	85.35
Mixed willow	1.54	1.46	14.56	0.16	0.19	0.83
Oregon ash groves	0.00	0.00	0.00	0.17	0.00	0.00
Oregon white oak woodland	0.00	0.00	0.00	1.09	0.00	0.66
Ponderosa pine–Douglas fir forest	5.01	0.00	28.37	50.04	69.14	127.51
Ponderosa pine forest	226.04	36.67	212.79	208.87	59.38	101.21
Red osier thickets	0.00	0.00	0.00	0.12	0.00	0.00
Riverine[1]	0.00	0.88	5.24	15.42	1.41	0.00
Sandbar willow thickets	0.00	0.00	0.00	0.28	0.07	0.00
Spicebush thickets	0.00	0.00	0.00	0.06	0.00	0.00
Urban[1]	22.04	0.00	0.00	0.00	0.00	1.92
White alder groves	1.34	4.46	9.70	12.40	1.18	2.85
White leaf manzanita chaparral	16.80	12.30	98.21	6.13	7.49	2.86
Total	10,655.47	1,105.79	7,944.75	5,468.00	2,324.09	4,900.34

Notes

* Data to be provided at a later date.

[1] WHR Wildlife Habitat Type (Mayer and Laudenslayer 1988); no corresponding plant series type included in A Manual of California Vegetation (Sawyer et al. 2009).

**Lacustrine values are included for the entire surface area of Shasta Lake. The extent of activity occurring within Shasta Lake has yet to be determined.

Barren Barren habitat consists mainly of nonvegetated man-made features. Barren habitat is scattered throughout the Shasta Lake and vicinity portion of the primary study area, including boat ramps, parking lots, and roads. Other barren habitats are a large gravel plain feature at the confluence of Butcher Creek and Shasta Lake (Main Body) and a sealed riprap feature adjacent to Interstate 5 (I-5) near the upper Sacramento Arm and Shasta Lake confluence. Vegetation is usually not present, although sparse opportunistic grasses/forbs or weedy species may occur.

Birch Leaf Mountain-Mahogany Chaparral Birch-leaf mountain-mahogany chaparral is a relatively common associate species in many chaparral and woodland plant series types. As a plant series, birch-leaf mountain-mahogany occurs in the Shasta Lake and vicinity portion of the primary study area along the upper McCloud and Sacramento arms. These sites are located on floodplain terraces and are characterized as moderate to dense chaparral stands dominated by birch-leaf mountain-mahogany (*Cercocarpus betuloides*), with occasional buck brush (*Ceanothus cuneatus*), poison oak (*Toxicodendron diversilobum*), western redbud (*Cercis occidentalis*), yerba santa (*Eriodictyon californicum*), and Brewer oak (*Q. garryana* var. b*reweri*).

Black Willow Thicket Although commonly associated with willow and other riparian plant series types, black willow thicket is uncommon in the Shasta Lake and vicinity portion of the primary study area. This plant series is dominated by black willow (*Salix gooddingii*), with spicebush (*Calycanthus occidentalis*), rushes (*Juncus* spp.), and California grape (*Vitis californica*). It occurs at only two locations in the Shasta Lake and vicinity portion of the primary study area, one along the Sacramento Arm and the other in the Jones Valley area (Pit Arm).

Blue Oak Woodland The blue oak plant series occurs mainly as small inclusions within other more prevalent plant series types; however, moderate-sized stands also occur. This plant series occurs at scattered locations along the Main Body, McCloud Arm, and Pit Arm and is characterized by open to moderate woodlands dominated by blue oak (*Quercus douglasii*). Associated tree species include occasional interior live oak (*Q. wislizenii* var. *wislizenii*) and gray pine (*Pinus sabiniana*). The shrub layer is open or absent, and a moderate to dense forb layer dominates the understory.

Brewer Oak Scrub The Brewer oak plant series consists of moderate to very dense stands of Brewer oak, the shrub form of Oregon white oak (*Q. garryana* var. *garryana*). This plant series type is widespread throughout the Shasta Lake and vicinity portion of the primary study area. Brewer oak stands are often nearly pure; occasionally, however, shrub species such as poison oak, white leaf manzanita, yerba santa, buck brush, bush poppy (*Dendromecon rigida*), Fremont's silktassel (*Garrya fremontii*), deer brush (*Ceanothus integerrimus*), skunkbrush (*Rhus trilobata*), and snowdrop bush (*Styrax officinalis*) occur in association with Brewer oak.

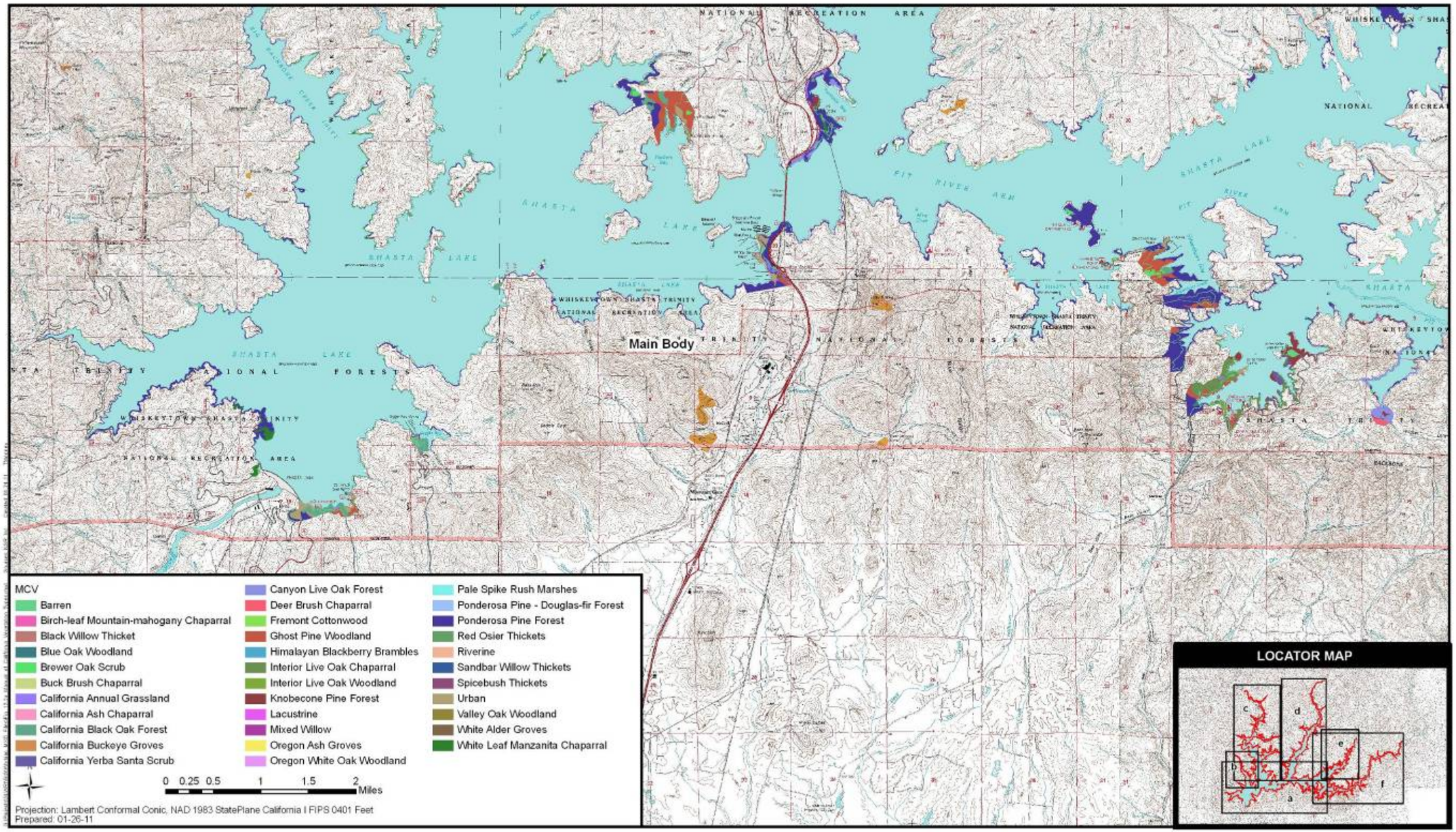

Figure 1-2a. Manual of California Vegetation Types

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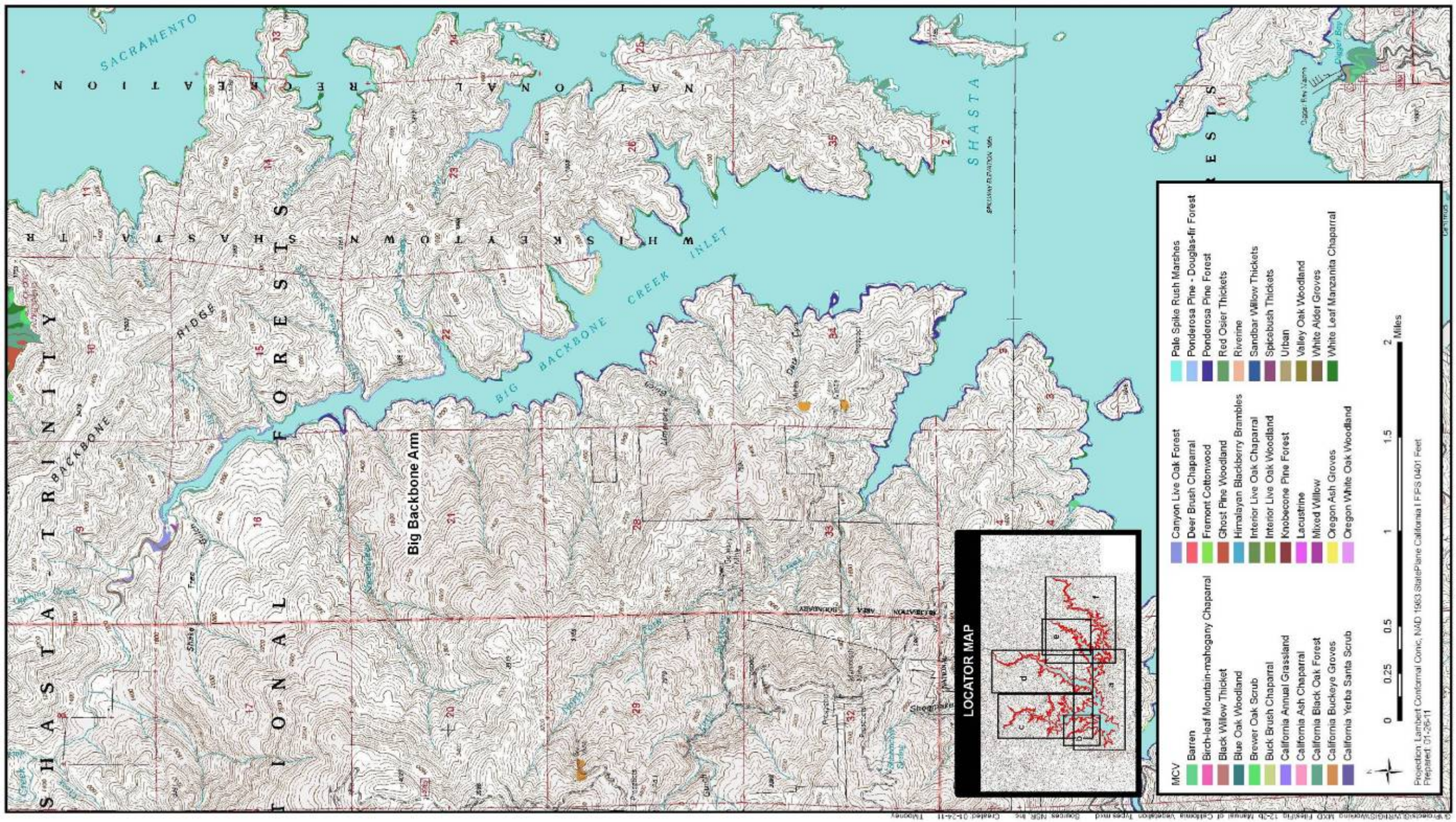

Figure 1-2b. Manual of California Vegetation Types

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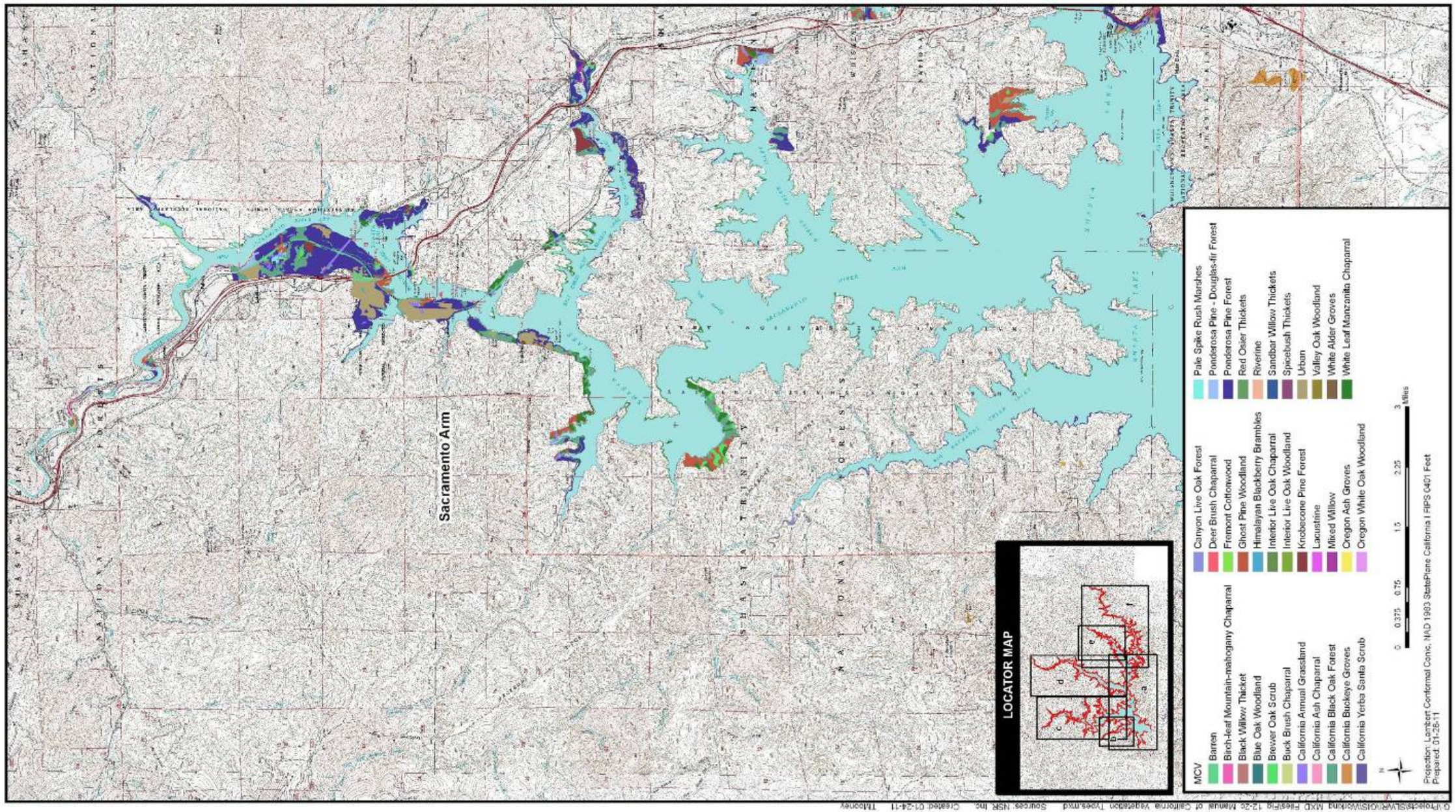

Figure 1-2c. Manual of California Vegetation Types

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Figure 1-2d. Manual of California Vegetation Types

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Figure 1-2e. Manual of California Vegetation Types

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Figure 1-2f. Manual of California Vegetation Types

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Table 1-2. Summary of Plant Communities in the Relocation Areas

Plant Series	Area (Acres)					
	Main Body	Big Backbone Arm	Sacramento Arm	McCloud Arm	Squaw Creek Arm	Pit Arm
Barren[1]	23.76	0.00	88.27	36.62	12.15	22.19
Birch-leaf mountain-mahogany chaparral	0.00	0.00	0.07	2.57	0.00	0.00
Black willow thicket	0.00	0.00	0.03	0.00	0.00	0.00
Blue oak woodland	0.00	0.00	0.00	3.89	0.00	2.29
Brewer oak scrub	9.24	0.00	0.00	23.83	0.00	0.91
Buck brush chaparral	0.00	0.00	1.30	2.11	0.00	0.22
California annual grassland	5.02	0.00	23.24	10.65	1.29	1.25
California ash chaparral	0.00	0.00	0.00	0.68	0.00	0.00
California black oak forest	45.08	0.00	190.50	124.80	1.29	0.72
California buckeye groves	0.30	0.00	0.00	1.58	0.00	0.00
California yerba santa scrub	0.33	0.00	0.00	0.00	0.00	18.5
Canyon live oak forest	1.18	0.00	13.92	99.86	4.98	32.58
Deer brush chaparral	0.18	0.00	0.00	0.65	0.00	9.67
Fremont cottonwood forest	0.00	0.00	0.56	0.00	0.00	0.05
Ghost pine woodland	124.50	0.00	84.08	49.91	13.48	20.05
Himalayan blackberry brambles	0.18	0.00	0.00	0.06	0.00	0.16
Interior live oak chaparral	0.00	0.00	2.42	0.00	0.00	64.85
Interior live oak woodland	0.72	0.00	0.00	0.00	0.00	3.41
Knobcone pine forest	0.11	0.00	55.68	12.50	1.94	39.25
Lacustrine	0.00	0.00	0.00	32.49	0.00	0.00
Mixed willow	0.079	0.00	1.26		0.06	1.11
Oregon ash groves	0.00	0.00	0.00	0.50	0.00	0.00
Oregon white oak woodland	0.00	0.00	0.00	5.82	0.07	0.00

Table 1-2. Summary of Plant Communities in the Relocation Areas (contd.)

Plant Series	Area (Acres)					
	Main Body	Big Backbone Arm	Sacramento Arm	McCloud Arm	Squaw Creek Arm	Pit Arm
Pale spike rush marshes	0.00	0.00	6.51	0.00	0.00	0.00
Ponderosa pine–Douglas fir forest	0.00	0.00	23.78	155.57	28.80	19.27
Ponderosa pine forest	185.35	0.00	557.30	501.66	43.08	62.03
Riverine[1]	3.75	0.00	0.39	0.00	0.00	0.00
Sandbar willow thickets	0.00	0.00	0.00	0.37	0.00	0.00
Spicebush thickets	0.00	0.00	0.00	0.70	0.00	0.00
Urban[1]	21.05	0.00	229.37	0.48	0.00	2.49
Valley oak woodland	0.00	0.00	1.05	0.00	0.00	0.00
White alder groves	0.00	0.00	2.51	6.33	0.17	0.00
White leaf manzanita chaparral	15.97	0.00	78.43	14.98	4.38	0.40
Total	433.05	0.00	1,400.06	1,092.36	111.67	301.40

Note:
[1] WHR Wildlife Habitat Type (Mayer and Laudenslayer 1988); no corresponding plant series type included in *A Manual of California Vegetation* (Sawyer et al. 2009).

Buck Brush Chaparral Buck brush chaparral occurs at scattered locations throughout the Shasta Lake and vicinity portion of the primary study area. This plant series is dominated by moderate to dense stands of buck brush. Associated species include white leaf manzanita, poison oak, western redbud, yerba santa, Brewer oak, birch-leaf mountain-mahogany, and coffeeberry (*Rhamnus* sp.).

California Annual Grassland California annual grassland is uncommon in the Shasta Lake and vicinity portion of the primary study area, occurring only as small inclusions in other more prevalent plant series types or in areas subjected to previous disturbance. Dominant species include wild oat (*Avena fatua*), cheatgrass (*Bromus tectorum*), ripgut (*B. diandrus*), yellow star-thistle (*Centaurea solstitialis*), squirreltail (*Elymus elymoides*), and European hairgrass (*Aira caryophyllea*).

California Ash Chaparral California ash is a relatively common associate species in many chaparral and woodland plant series types. As a plant series, California ash chaparral occurs in the Shasta Lake and vicinity portion of the primary study area at several locations along the McCloud Arm. This plant series is characterized as a moderate to dense chaparral stand dominated by

birch-leaf mountain-mahogany, with occasional buck brush, poison oak, western redbud, yerba santa, and Brewer oak.

California Black Oak The black oak series is characterized by moderate to dense stands of California black oak (*Quercus kelloggii*). This plant series is relatively common throughout the Shasta Lake and vicinity portion of the primary study area. Understory associates include white leaf manzanita (*Arctostaphylos viscida*), poison oak, snowdrop bush (*Styrax officinalis*), and buck brush. The ground layer is open to dense and is dominated by various grasses and forbs.

California Buckeye Groves Although a common associate in many plant series types in the Shasta Lake and vicinity portion of the primary study area, California buckeye groves are uncommon as a plant series type. This plant series is dominated by California buckeye (*Aesculus californica*). Associated species include poison oak, Brewer oak, buck brush, and various grasses and forbs. It occurs at only several scattered locations in the Sacramento Arm, McCloud Arm, and Pit Arm.

California Yerba Santa Scrub California yerba santa scrub is a relatively common associate species in many chaparral and woodland plant series types. California yerba santa is a pioneer species that readily responds to various disturbances and wildfire. As a plant series, California yerba santa scrub occurs in the Shasta Lake and vicinity portion of the primary study area at two general locations subject to recent wildfire: the Dry Creek area (Main Body) and the Jones Valley area (Pit Arm). This plant series is characterized as moderate to dense chaparral stands dominated by California yerba santa, with occasional shrub interior live oak, shrub canyon live oak, buck brush, poison oak, western redbud, and Brewer oak.

Canyon Live Oak Forest The canyon live oak plant series is characterized by moderate to dense stands of canyon live oak (*Quercus chrysolepis*). This plant series is relatively common throughout the Shasta Lake and vicinity portion of the primary study area. Associated tree species include occasional California black oak. Understory associates include white leaf manzanita and poison oak. The ground layer is open to moderate and is dominated by various grasses and forbs.

Deer Brush Chaparral Deer brush chaparral is a relatively common associate in chaparral and forest plant series types in the Shasta Lake and vicinity portion of the primary study area; however, deer brush is uncommon in the study area as a plant series type. This plant series is dominated by deer brush. It occurs at several scattered locations along the Main Body, McCloud Arm, and Pit Arm.

Fremont Cottonwood Forest In the Shasta Lake and vicinity portion of the primary study area, Fremont cottonwood forest is an uncommon plant series type that occurs as single stands of trees along small portions of the upper

Sacramento Arm and the Pit Arm. The dominant species is Fremont cottonwood (*Populus fremontii*).

Ghost (Gray) Pine The ghost pine plant series occurs in all parts of the Shasta Lake and vicinity portion of the primary study area except along the Big Backbone Arm. This plant series type is characterized by open to moderate stands of gray pine. Associated species include blue oak, canyon live oak, interior live oak, and California black oak. Shrub species are moderate to dense and include white leaf manzanita, western redbud, buck brush, Brewer oak, poison oak, and yerba santa.

Himalayan Blackberry Brambles Himalayan blackberry (*Rubus discolor*) is a common associate in many riparian plant series and in various other plant series with mesic microhabitats and/or previous disturbance. As a plant series, Himalayan blackberry brambles occur in portions of the Dry Creek (Main Body) and Jones Valley (Pit Arm) areas recently disturbed by wildfire. This plant series occurs in and along drainage and stream features and is characterized as dense thickets of Himalayan blackberry. Associated species include spicebush, willow, and rushes.

Interior Live Oak Chaparral In the Shasta Lake and vicinity portion of the primary study area, the interior live oak chaparral plant series is relatively uncommon, occurring mainly along the Sacramento Arm. However, this plant series also occurs at scattered locations along the Main Body, the McCloud Arm, and the Pit Arm. This plant series is dominated by moderate to dense stands of the shrub form of interior live oak. Associated species include Brewer oak, white leaf manzanita, poison oak, and buck brush.

Interior Live Oak Woodland The interior live oak woodland plant series is uncommon in the Shasta Lake and vicinity portion of the primary study area. It occurs in several small areas along the Sacramento Arm, the Pit Arm, the McCloud Arm, and the Main Body.

Knobcone Pine Forest The knobcone pine forest plant series consists of open to dense knobcone pine (*Pinus contorta*) stands. This plant series is scattered throughout all portions of the Shasta Lake and vicinity portion of the primary study area. Knobcone pine forest often occurs at locations characterized by disturbances, including historic mining activities and past or recent wildfires. Dominant species include knobcone pine, with occasional canyon live oak, California black oak, ponderosa pine (*Pinus ponderosa*), and gray pine. The shrub layer is moderate to dense and is dominated by white leaf manzanita and poison oak. The ground layer varies and is dominated by various grasses and forbs.

Lacustrine Lacustrine habitat consists of the area regularly inundated by Shasta Lake (i.e., areas at and below the 1,070-foot elevation). Most of this area is barren of vegetation and is characterized as exposed soil and/or rock. Portions

of the lacustrine habitat do support vegetation, including woody riparian species such as black willow, button willow (*Cephalanthus occidentalis*), Fremont cottonwood, and various grasses and forbs, during draw-down periods.

Mixed Willow Mixed willow is the most common willow plant series type in the Shasta Lake and vicinity portion of the primary study area and occurs throughout the entire area. Dominant species include red willow (*Salix laevigata*), black willow, shining willow (*S. lasiandra*), arroyo willow (*S. lasiolepis*), and narrowleaf willow (*S. exigua*).

Oregon Ash Groves Oregon ash groves are an uncommon plant series type in the Shasta Lake and vicinity portion of the primary study area. This type occurs along the upper McCloud Arm and is dominated by open to moderate stands of Oregon ash (*Fraxinus latifolia*) with willow, California grape, mock orange, brickellbush (*Brickellia* sp.), and poison oak.

Oregon White Oak Woodland The Oregon white oak woodland plant series is uncommon in the Shasta Lake and vicinity portion of the primary study area and occurs as small inclusions in other more prevalent plant series types. This plant series is characterized by open to moderate woodlands dominated by Oregon white oak. Associated tree species include occasional canyon live oak, blue oak, and California black oak. The shrub layer is open or absent, and a moderate to dense forb layer dominates the understory.

Pale Spike Rush Marshes Pale spike rush is an uncommon plant series in the Shasta Lake and vicinity portion of the primary study area; it is known to occur only in a portion of one relocation area near Lakehead (Sacramento Arm). This plant series is characterized as a seasonal wetland dominated by a complex of annual and perennial upland and wetland plant species. Dominant species include pale spike rush (*Eleocharis macrostachya*), jointed coyote-thistle (*Eryngium articulatum*), pennyroyal (*Mentha pulegium*), panic grass (*Panicum acuminatum*), iris-leaf rush (*Juncus xiphioides*), sedges (*Carex* spp.), rushes, poison oak, white leaf manzanita, western choke-cherry (*Prunus virginiana*), interior rose (*Rosa woodsii*), and Himalayan blackberry.

Ponderosa Pine–Douglas-Fir Ponderosa pine–Douglas-fir is the second-most-common conifer plant series type in the Shasta Lake and vicinity portion of the primary study area, occurring everywhere except along the Big Backbone Arm. This plant series is characterized by open to dense conifer stands dominated by Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine. Associated species include occasional sugar pine (*P. lambertiana*), incense cedar (*Calocedrus decurrens*), canyon live oak, and California black oak. Associated understory species vary and include Pacific dogwood (*Cornus nuttallii*), mock orange (*Philadelphus lewisii*), poison oak, snowdrop bush, and white leaf manzanita. The ground layer is open to moderate and is dominated by various grasses and forbs.

Ponderosa Pine Ponderosa pine is the most common conifer plant series type in the Shasta Lake and vicinity portion of the primary study area and is scattered throughout all portions of the area. This plant series is characterized by open to dense conifer stands dominated by ponderosa pine. Associated species include occasional Douglas-fir, sugar pine, incense cedar, canyon live oak, and California black oak. Associated understory species vary and include redbud, buck brush, mock orange, poison oak, snowdrop bush, and white leaf manzanita. The ground layer is open to moderate and is dominated by various grasses and forbs.

Red Osier Thickets Red osier is a common associate in many riparian plant series types in the Shasta Lake and vicinity portion of the primary study area. As a plant series, red osier thickets are an uncommon plant series type. In the vicinity of Shasta Lake, red osier thickets are found along the upper McCloud Arm. Dominant species include red osier (*Cornus stolonifera*), brown dogwood (*C. glabrata*), mock orange, spicebush, and California grape.

Riverine Riverine habitat includes the free-flowing portions of the larger Shasta Lake tributaries occurring in the Shasta Lake and vicinity portion of the primary study area. The riverine habitat is highly variable and ranges from moderate, low-gradient to steep, well-confined stream reaches.

Sandbar Willow Thickets Sandbar willow thicket is an uncommon plant series that occurs at one location each along the McCloud Arm and the Squaw Creek Arm. Dominant species include narrowleaf willow, with occasional red willow, black willow, shining willow, and arroyo willow.

Spicebush thickets Spicebush is a common associate in many riparian plant series types in the Shasta Lake and vicinity portion of the primary study area. As a plant series, spicebush thickets are an uncommon plant series type. This plant series occurs at several locations along the McCloud Arm. Dominant species include spicebush, red osier, mock orange, and California grape.

Urban Urban habitat consists of various man-made features scattered throughout the Shasta Lake and vicinity portion of the primary study area, including resorts and a portion of the visitor center complex at Shasta Dam. These features are typically a combination of various buildings, pavement areas with manicured landscaping, and lawns.

Valley Oak Woodland Valley oak woodland is an uncommon plant series and occurs at two small locations in the Lakehead area (Sacramento Arm). Dominant species include valley oak (*Quercus lobata*) with white leaf manzanita, redbud, poison oak, and various grasses and forbs.

White Alder Groves The white alder plant series occurs in the riparian vegetation found in drainages throughout the Shasta Lake and vicinity portion of the primary study area. This plant series is characterized as narrow bands of

vegetation occurring in and along the margins of rivers, streams, or other drainages. Dominant species include white alder (*Alnus rhombifolia*) with occasional Oregon ash, red osier, big-leaf maple (*Acer macrophyllum*), narrowleaf willow, red willow, shining willow, and arroyo willow. Associated shrubs include spicebush, mock orange, California blackberry (*Rubus ursinus*), mugwort (*Artemisia douglasiana*), ninebark (*Physocarpus capitatus*), and western azalea (*Rhododendron occidentale*). Common lianas include California grape, pipevine (*Aristolochia californica*), greenbriar (*Smilax californica*), and virgin's bower (*Clematis ligusticifolia*). The ground layer is open to dense and is dominated by sedges with various grasses and forbs.

White Leaf Manzanita Chaparral White leaf manzanita is the most common chaparral plant series type in the Shasta Lake and vicinity portion of the primary study area and is scattered throughout all portions of the area. The dominant species is white leaf manzanita. Associated species include occasional common manzanita (*A. manzanita*), western redbud, buck brush, deer brush, poison oak, birch-leaf mountain-mahogany, interior live oak (shrub form), Fremont's silktassel, bush poppy, yerba santa, and Brewer's oak.

Upper Sacramento River (Shasta Dam to Red Bluff) Vegetation within the Sacramento River Valley includes a variety of both upland and lowland plant communities, including a number of communities that are considered sensitive. Plant community names and descriptions used in this report are based primarily on the *Preliminary Descriptions of the Terrestrial Natural Communities of California* (Holland 1986). Additional plant community information was obtained from *A Manual of California Vegetation* (Sawyer and Keeler-Wolf 1995), *A Guide to Wildlife Habitats of California* (Mayer and Laudenslayer 1988), and from the *Shasta Lake Water Resources Investigation Initial Alternatives Report* (Reclamation 2004). Also, for each plant community, the corresponding Natural Community Conservation Plan (NCCP) habitat type of the *Multi-Species Conservation Strategy* (MSCS) for the CALFED Bay-Delta Program (CALFED) (2000a) is noted. The plant communities present in the primary study area between Shasta Dam and RBDD are grouped into common and sensitive communities, and the relevant aspects of their ecology are discussed. These descriptions are generally applicable to the extended study area as well.

Common Plant Communities Common plant communities present within the primary study area include annual grassland, chaparral, and agricultural lands. The upper banks along steep-sided, bedrock constrained segments of the Sacramento River and its tributaries are characterized primarily by upland communities including blue oak woodland, foothill pine–oak woodland, and chaparral. These segments occur primarily between Shasta Dam and Redding.

Annual Grassland Annual grassland is an herbaceous plant community characterized by a dense cover of nonnative annual grasses with numerous species of nonnative annual forbs, as well as native wildflowers. Typical grass

species include bromes (*Bromus diandrus*, *B. hordeaceus*, and *B. madritensis* ssp. *rubens*), wild oat (*Avena fatua*), foxtail barley (*Hordeum murinum* ssp. *leporinum*), medusahead (*Taeniatherum caput-medusae*), and Italian ryegrass (*Lolium multiflorum*). Common nonnative forbs include vetches (*Vicia* spp.), filarees (*Erodium* spp.), and clovers (*Trifolium* spp.). Native wildflowers such as California poppy (*Eschschozia californica*), frying pans (*Eschscholzia lobbii*), California goldfields (*Lasthenia califonica*), Fremont's tidy-tips (*Layia fremontii*), rusty popcorn flower (*Plagiobothrys nothofulvus*), and Fitch's tarweed (*Hemizonia fitchii*) are also a common component of the annual grassland community. This plant community occurs in openings and disturbed areas throughout the study area and also characterizes the understory of the woodland plant communities. Annual grassland corresponds to the MSCS NCCP habitat "grassland."

Although the annual grasslands of the Central Valley and surrounding foothills are dominated by a small number of nonnative annual grasses, this natural community includes a large number of species, particularly species with an annual life history, both natives and nonnatives. These species differ substantially in the timing and duration of germination, growth, and reproduction. As a consequence, grassland structure and species composition vary substantially both throughout the growing season and from year to year. In response to annual patterns of temperature and rainfall, grassland structure and species composition also varies from one year to the next.

Chaparral Chaparral communities are characterized by dense cover of drought-tolerant shrubs, generally 6 – 12 feet tall. This plant community typically occurs on dry, rocky, thin-soiled slopes that are often steep and have southern aspects. Chaparral communities in the primary study area are typically dominated by common manzanita or buckbrush and have only a sparse herbaceaous layer. Chaparral communities in the extended study area may be dominated by any one of several species of manzanita or ceanothus, or may be dominated by other species such as chamise (*Adenostoma fasciculatum*), scrub oak (*Quercus dumosa*), or interior live oak. Chaparral communities are within the MSCS habitat type "upland scrub."

The dynamics of chaparral are closely related to fire. Because the crowns of chaparral shrubs are at or within several feet of the ground surface, they are killed by fire. However, many chaparral shrubs produce new stems from their stem bases. These "sprouters" and a number of nonsprouting species (of both shrubs and herbvaceous species) also have a soil seedbank of dormant seed that are stimulated to germinate following fire. Following fire, sprouts and seedlings rapidly restore the shrub layer, which after reforming changes in structure and species composition much more slowly than during the first decade following a fire.

Agricultural Lands Much of the land within the Sacramento River Valley has been converted to agricultural uses. A variety of crops are cultivated

in the fertile floodplain soils between Redding and Red Bluff, including irrigated row and field crops (e.g., rice, beans, melons, and alfalfa) and orchards and vineyards (e.g., grapes, walnuts, almonds, and grapes). Vegetation on the edges of agricultural fields is typically dominated by invasive annual grasses and forbs such as ripgut brome (*Bromus diandrus*), wild oats, Italian ryegrass, wild radish (*Raphanus sativus*), and field bindweed (*Convolvulus arvensis*). MSCS habitats include a "seasonally flooded agricultural land" category that includes any agricultural land that requires at least 1 week of flooding as a management practice. The MSCS does not include any habitat types for other agricultural lands.

These lands go through frequent, often seasonal cycles of tillage, seedbed preparation, seeding, crop growth, and harvesting, with applications of irrigation water, fertilizers, pesticides, and herbicides. Consequently, they progress from exposed soil to formation of a uniform, low, layer of herbaceous plants (dominated by a single species), to disturbance of the herbaceous layer and the underlying soil. The vegetation is low (1 foot to several feet high), uniform in structure, and except for irrigated pastures, generally of a single crop species and associated weeds.

Sensitive Plant Communities Sensitive plant communities include those that are of special concern to resource agencies or are afforded specific consideration through the California Environmental Quality Act (CEQA), Section 1602 of the California Fish and Game Code, Section 404 of the Federal Clean Water Act (CWA), and the State's Porter-Cologne Water Quality Control Act (Porter-Cologne Act), as discussed under "Regulatory Setting" below. Sensitive natural communities may be of special concern to these agencies and conservation organizations for a variety of reasons, including their locally or regionally declining status, or because they provide important habitat to common and special-status species. Many of these communities are tracked in the California Department of Fish and Game's (DFG) CNDDB, a statewide inventory of the locations and conditions of the state's rarest plant and animal taxa and vegetation types. Many riparian and wetland plant communities occurring in the primary study area are considered sensitive by regulatory agencies. In addition, valley oak woodland is identified as a sensitive natural community by DFG, and CEQA requires counties to consider treat all oak woodlands as sensitive communities. (Oak trees present in the study area also may be eligible for protection under local ordinances.) In the primary study area, in addition to the oak woodland, riparian, and wetland communities described above, sensitive natural communities include waters of the United States, including wetlands and navigable waters, which are subject to U.S. Army Corps of Engineers (USACE) jurisdiction. Potential waters of the United States in the primary study area include wetland communities and several named sloughs, canals, and irrigation ditches.

Figures 1-3a through 1-3j map the potential locations of sensitive plant communities along the Sacramento River from Shasta Dam to RBDD.

Oak Woodlands Oak woodlands present in the study area include blue oak woodland, blue oak savanna, foothill pine–oak woodland, and valley oak woodland.

Blue Oak Woodland Blue oak woodland is a broadleaved deciduous woodland plant community. The understory varies from grassy to shrubby. This plant community is dominated by blue oak (*Quercus douglasii*), but other oaks, including canyon live oak (*Q. chrysolepis*) and interior live oak (*Q. wislizenii*), are also typically present, as well as foothill pine (*Pinus sabiniana*). Common understory shrubs include common manzanita (*Arctostaphylos manzanita* ssp. *manzanita*), buckbrush (*Ceanothus cuneatus*), toyon (*Heteromeles arbutifolia*), redberry buckthorn (*Rhamnus crocea*), and poison oak (*Toxicodendron diversilobum*). Blue oak woodland occurs in valley uplands and on gentle to steep slopes with shallow, rocky, infertile soils that are moderately to excessively drained. Blue oak woodland is a community within the MSCS habitat type "valley/foothill woodland and forest."

Blue Oak Savanna Blue oak savanna is a broadleaved deciduous plant community characterized by an open tree canopy (typically less than 10 percent cover) and an understory of nonnative annual grasses and forbs interspersed with native wildflowers. The tree canopy is dominated by blue oak. Individual foothill pine trees occur occasionally in this community and patches of shrubs such as buckbrush, common manzanita, or toyon may also be present. Blue oak savanna typically occurs on south-facing slopes with thinner soils. Blue oak savanna is a community in the MSCS habitat type "valley/foothill woodland and forest."

Foothill Pine–Oak Woodland Foothill pine–oak woodland is an evergreen plant community characterized by a foothill pine–dominated tree canopy with oaks including blue oak and interior live oak as subdominants. This is a moderately open woodland community with an annual grassland understory. Shrub species including toyon, buckbrush, mountain mahogany (*Cercocarpus betuloides*), and common manzanita are often present. Foothill pine–oak woodland is widespread on east and northeast aspects. Foothill pine–oak woodland is a community in the MSCS habitat type "valley/foothill woodland and forest."

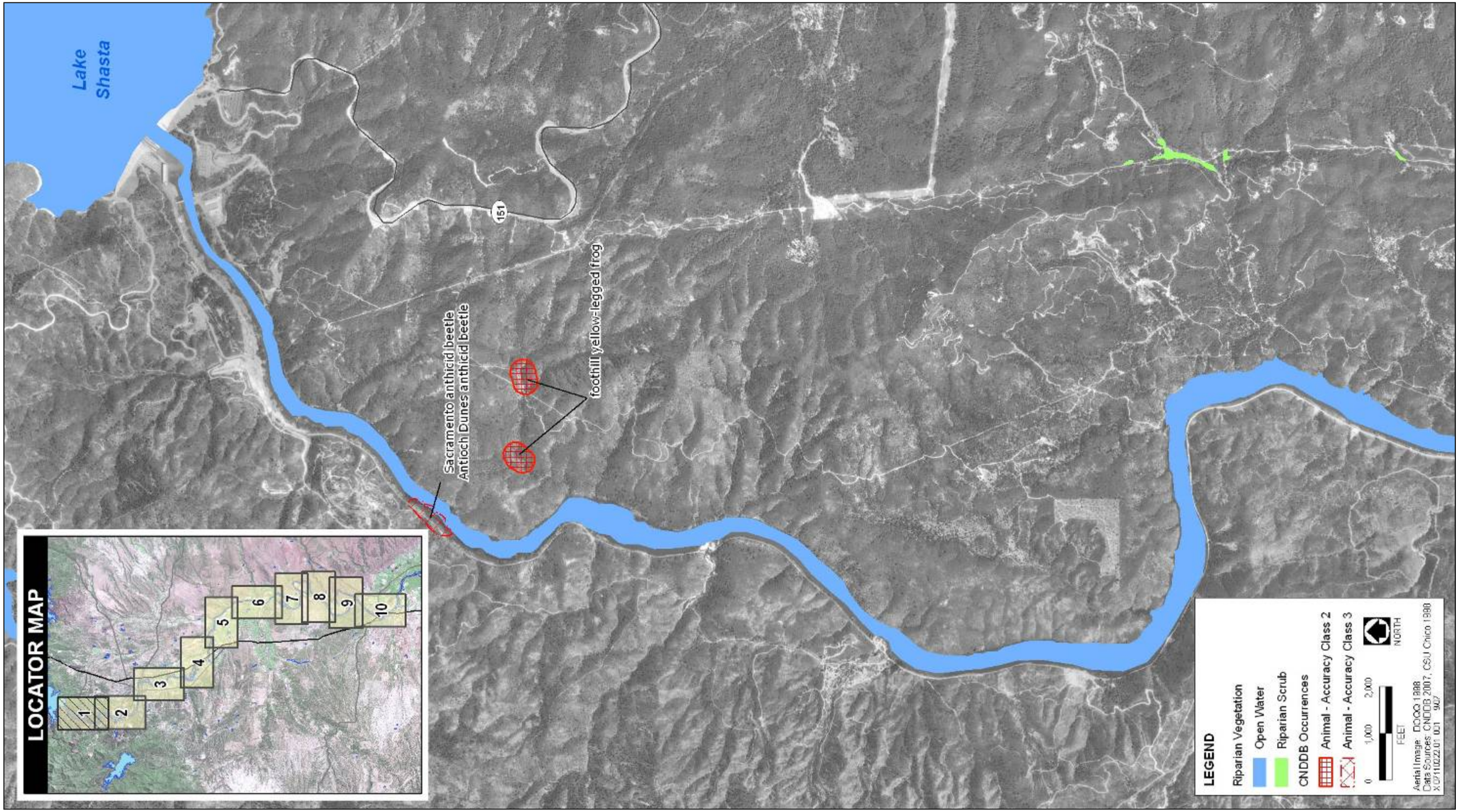

Figure 1-3a. Sensitive Biological Resources Between Shasta Dam and Red Bluff Diversion Dam

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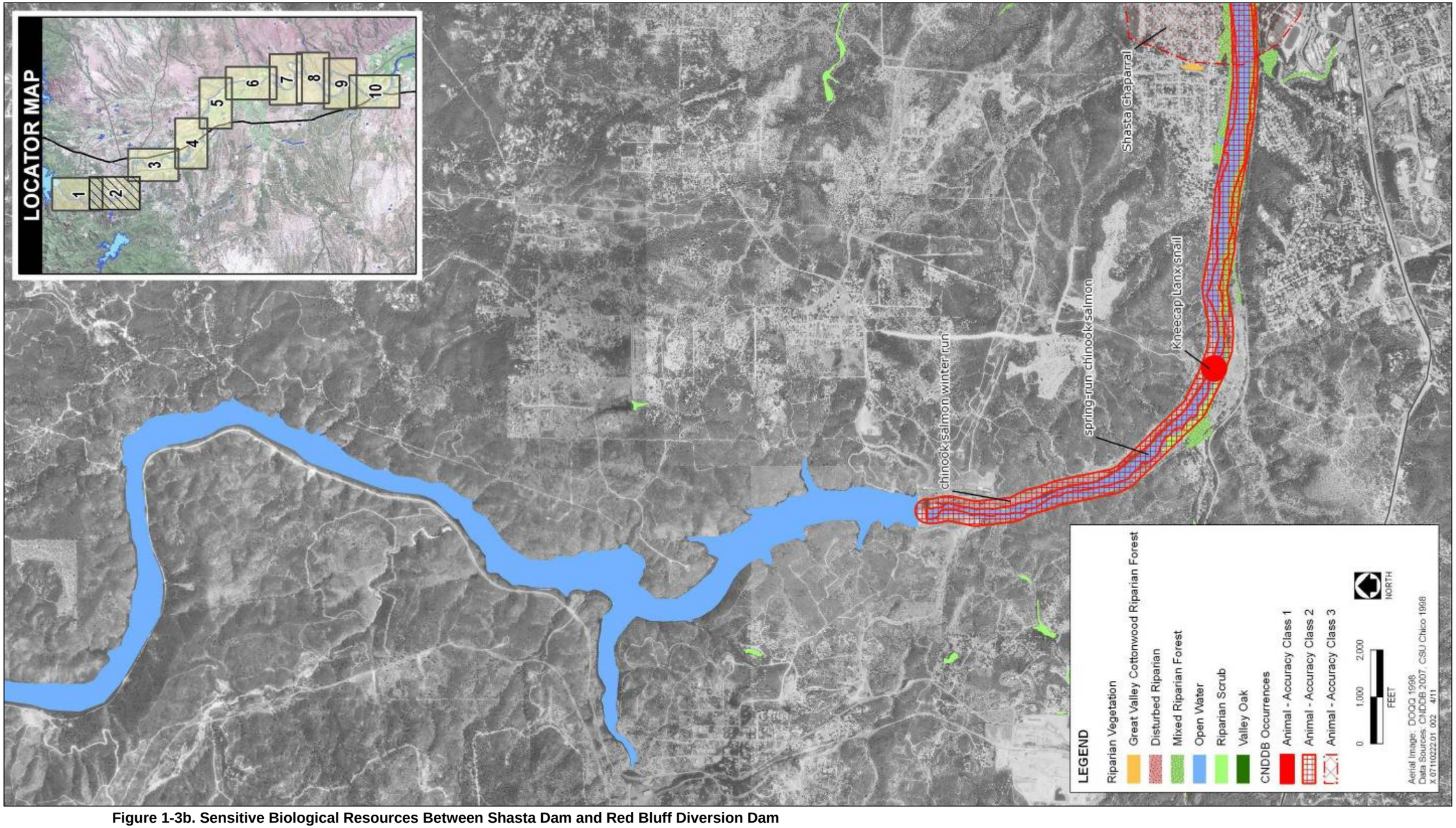

Figure 1-3b. Sensitive Biological Resources Between Shasta Dam and Red Bluff Diversion Dam

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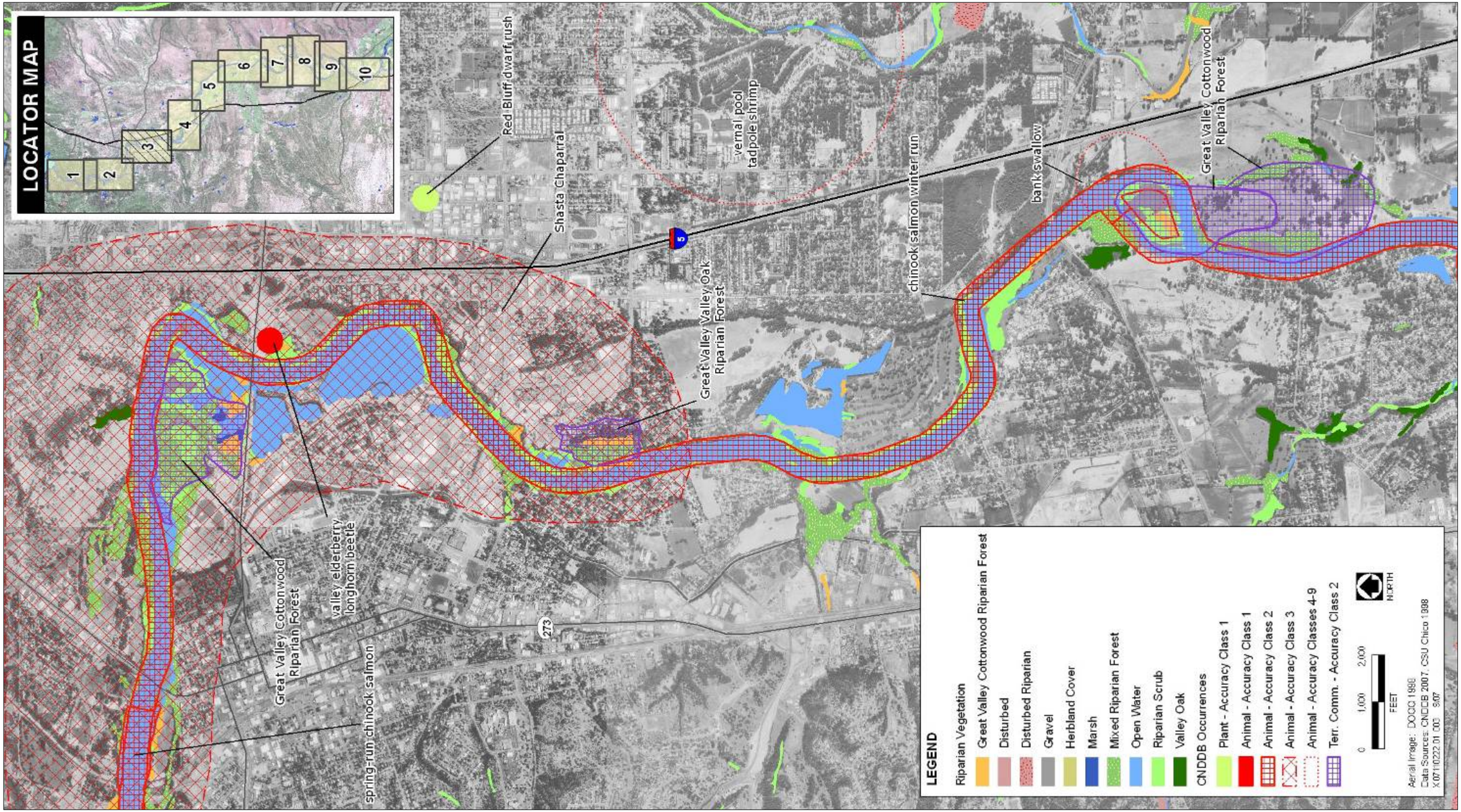

Figure 1-3c. Sensitive Biological Resources Between Shasta Dam and Red Bluff Diversion Dam

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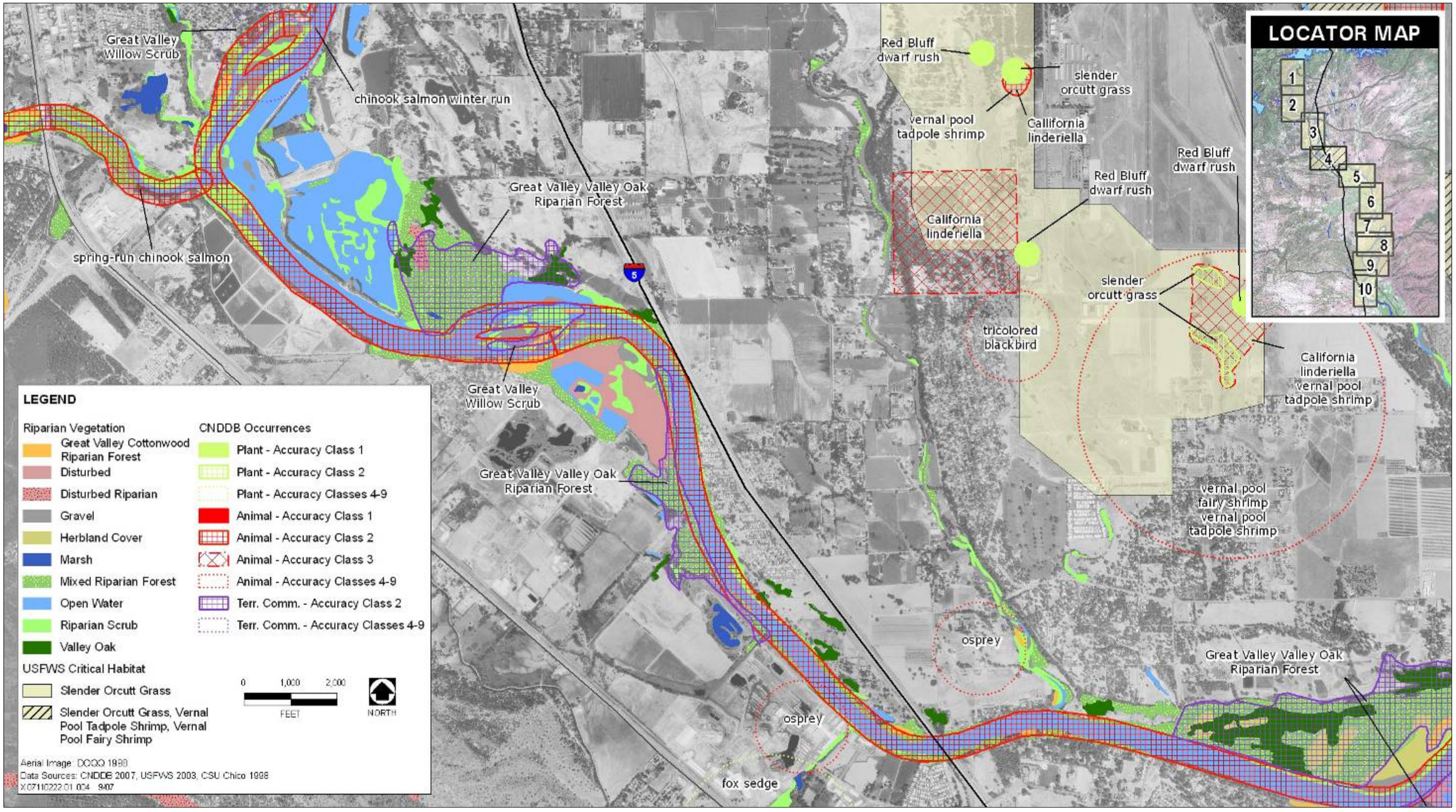

Figure 1-3d. Sensitive Biological Resources Between Shasta Dam and Red Bluff Diversion Dam

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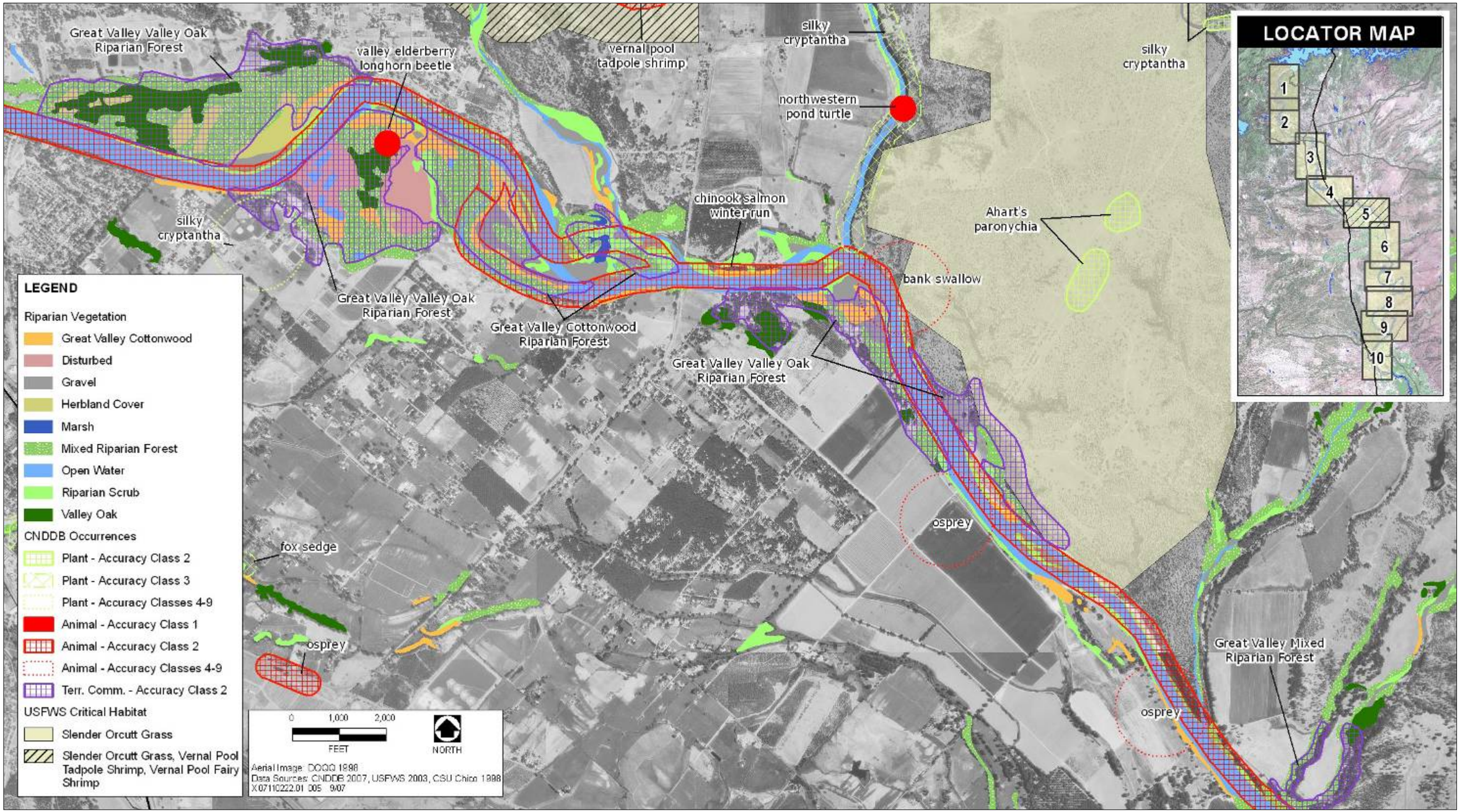

Figure 1-3e. Sensitive Biological Resources Between Shasta Dam and Red Bluff Diversion Dam

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